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CLAIMS

1. Process to produce a chemical or biological analysis multi-point micro-system, comprising steps consisting in:

a) coupling a reagent with a conductive polymer monomer,

b) depositing an electrolytic carrier solution ~~(14, 15, 16)~~ containing a mixture of said reagent coupled with said conductive polymer monomer in at least one micro-well of the micro-wells formed on a structure, each micro-well comprising a reception electrode and a counter-electrode, the electrolytic solution being deposited in sufficient quantity to close the electrochemical circuit between the reception electrode and the counter-electrode,

c) applying an electric field between the reception electrode and the counter-electrode to copolymerise and fix, in the micro-well where the electrolytic solution has been deposited, said conductive polymer with the reagents on the reception electrode,

d) rinsing the micro-wells of the structure to eliminate the remaining carrier solution.

2. Process according to claim 1, characterised in that steps a), b) and c) are repeated as many times as required to deposit the different reagents in different micro-wells.

substrate ~~(21)~~, one face of which comprises said reception electrodes ~~(22, 23, 24)~~ and is coated with a first layer of insulating material ~~(25)~~ comprising said micro-wells ~~(27)~~, the base of which corresponds to the reception electrodes, the first layer of insulating material supporting a conductive layer forming a common counter-electrode ~~(29)~~, multiplexing means being provided to connect all the reception electrodes simultaneously.

6. Micro-system according to ~~any of~~ claim~~s~~ 4 ~~or 5~~, characterised in that a second layer of insulating material ~~(38)~~ covers the conductive layer forming the counter-electrode ~~(32)~~ to embed it.

7. Micro-system according to claim 6, characterised in that the second layer of insulating material ~~(38)~~ supports a conductive layer used as a reference pseudo-electrode ~~(44)~~.

8 - Same as 6, except depend on claim 5
9 " " 7 " " " " 8

204393

CLAIMS

1. A method for producing a microsystem with multiple points for chemical or biological analysis, comprising the steps consisting of:

- designing a structure (20, 40) provided with microwells (21, 44), wherein each microwell is for receiving a reagent and is provided with fixation means for binding said reagent therein,

- obtaining a first organic compound (30) comprising a binding function with said fixation means and a binding function with a second organic compound, wherein both of these binding functions are separated by a spacer,

- obtaining a second organic compound (51) comprising a binding function with the corresponding binding function of the first organic compound (30) and comprising a reagent,

- fixing the first organic compound (30) on the fixation means (24) of the microwells (21) by means of its corresponding binding function,

- placing a second organic compound (51) in each microwell (21) for obtaining in each microwell (21), chemical or biological analysis probes formed by the reagent bound to the fixation means by the coupling of the corresponding binding functions of the first and second organic compounds.

2. The method according to claim 1, characterized in that the step consisting of fixing the first organic compound (30) on the fixation means (24) of the microwells (21) is performed by electropolymerization, wherein the fixation means are

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Related Case Serial No: 09/806,499
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electrically accessible conducting means, the binding function of the first organic compound (30) with the fixation means is formed by a conducting monomer, a counter electrode (25) is used for performing the electropolymerization.

3. The method according to claim 2, characterized in that the conducting means comprise an electrode (42) common to all the microwells.

4. The method according to claim 2, characterized in that said structure (40) is designed from a substrate (41), a face of which has said common electrode (42), wherein an insulating material layer (43) is deposited on said common electrode, the insulating material layer is excavated up to said common electrode (42) in order to form the microwells (44), the bottom of which is formed by the common electrode.

5. The method according to claim 2, characterized in that said structure (20) is designed from an active substrate (22) having a plurality of electrodes (24) on one of its faces, wherein this plurality of electrodes forms the fixation means, an insulating material layer (23) is deposited on said face, the insulating material layer (23) is excavated up to the electrodes (24) in order to form the microwells, multiplexing means are provided for electrically connecting the plurality of electrodes (24) in order to perform the electropolymerization.

6. The method according to any of claims 2 to 5,

characterized in that the counter electrode (9b, 25) is an electrode integrally formed with said structure.

7. The method according to any of claims 2 to 5, characterized in that the counter electrode is an electrode (48) placed opposite to the fixation means during the electropolymerization operation.

8. The method according to any of claims 2 to 7, characterized in that the conducting monomer of the first organic compound (30) is pyrrol.

9. The method according to claim 1, characterized in that the step consisting of fixing the first organic compound (30) on the fixation means (24) of the microwells (21) consists of implementing a covalent bond between the binding function of the first organic compound with the fixation means, and the fixation means.

10. The method according to claim 1, characterized in that the step consisting of fixing the first organic compound on the fixation means of the microwells is performed via a chemical route, by adding a reagent able to cause polymerization of the first organic compound on the fixation means.

11. The method according to claim 10, characterized in that the first organic compound is pyrrol and in that the reagent able to cause polymerization is a ferric salt.

12. The method according to any of claims 1 to

11, characterized in that the binding function of the first organic compound (30) with the second organic compound (51) is a biotin function, the binding function of the second organic compound (51) with the first organic compound (30) is an avidin or streptavidin function.

13. The method according to claim 12, characterized in that the first organic compound (30) is a biotinylated pyrrol.

14. The method according to any of claims 12 or 13, characterized in that the second organic compound (51) is formed by said reagent directly bound to the avidin or streptavidin function.

15. The method according to claim 14, characterized in that the step consisting of placing the second organic compound (51) in each microwell (21), consists of depositing a solution (50) containing the second organic compound (51) in each microwell (21), then removing this solution in order to only keep the obtained probes.

16. The method according to any of claims 12 or 13, characterized in that the second organic compound (51) is formed by said reagent bound to the avidin or streptavidin function via a biotin function.

17. The method according to claim 16, characterized in that the step consisting of placing the second organic compound (51) in each microwell (21), consists of depositing a first avidin or

streptavidin solution in each microwell, then removing this first solution in order to reveal the first organic compound (30) with the biotin function complexed by said avidin or said streptavidin, then depositing a second solution containing said reagent in a biotinylated form, and then removing this second solution in order to only keep the obtained probes.

18. A microsystem with multiple points for chemical or biological analysis formed by a structure (20, 40) provided with microwells (21, 44), wherein each microwell is for receiving a reagent and is provided with fixation means (24) for binding said reagent therein via a first organic compound (30), wherein the reagent is part of a second organic compound (51), the first organic compound (30) includes a binding function with the second organic compound (51) and a binding function with the fixation means (24), wherein both of these binding functions are separated by an spacer, the second organic compound (51) includes a binding function with the corresponding binding function of the first organic compound (30).

19. The microsystem according to claim 18, characterized in that the fixation means are electrodes (9a, 24) and in that the binding function with the fixation means of the first organic compound is a conducting polymer.

20. The microsystem according to claim 19, characterized in that the fixation means form a common electrode (42).

21. The microsystem according to any of claims 19 or 20, characterized in that the microwells (21) are formed in an insulating layer (23) of said structure (20), wherein the fixation means (24) form the bottom of the microwells.

22. The microsystem according to any of claims 19 to 21, characterized in that said structure (20) includes a counter electrode (25) positioned opposite to the bottom of the microwells, so that an electric field may be established between the counter electrode and the fixation means (24).

23. The microsystem according to any of claims 19 to 21, characterized in that said conducting polymer is a polypyrrol.

24. The microsystem according to claim 18, characterized in that the fixation means and the binding function of the first organic compound with the fixation means are such that they form a covalent bond.

25. The microsystem according to claim 18, characterized in that the binding function of the first organic compound with the fixation means includes a polymerization reagent, via a chemical route, on the fixation means.

26. The microsystem according to claim 25, characterized in that said reagent is a ferric salt.

27. The microsystem according to any of claims 18 to 26, characterized in that the first organic compound

(30) comprises a biotin function for its binding with an avidin or streptavidin function of the second organic compound (51).

28. The microsystem according to claim 27, characterized in that the first organic compound (30) is a biotinylated polypyrrol.

29. The microsystem according to any of claims 27 or 28, characterized in that the second organic compound (51) is formed by said reagent directly bound to the avidin or streptavidin function.

30. The microsystem according to any of claims 27 or 28, characterized in that the second organic compound (51) is formed by said reagent bound to the avidin or streptavidin function via a biotin function.

203496

CLAIMS

1. Device for chemical or biological analysis comprising a carrier containing a plurality of analysis sites able to fix a chemical or biological reagent, in which the analysis sites are formed of microdishes (23, 53) hollowed out of the carrier (21, 51), the side walls and the bottom of the microdishes and the areas of the carrier surface surrounding each microdish, called microdish edges, being made in at least one hydrophilic material (24, 26, 55, 57) and the planar areas of the carrier arranged between the areas surrounding the microdishes being made in a hydrophobic material (27, 59).

2. Device according to claim 1, in which the microdishes have the shape of a flattened cone whose smaller base corresponds to the bottom of the microdish.

3. Device according to claim 1 or 2, in which the side walls, the bottoms and the edges of the microdishes are made in the same hydrophilic material.

4. Device according to claim 1 or 2, in which the bottoms of the microdishes are made in a first hydrophilic material (24, 55), and at least part of the side walls of the microdishes and the edges of the microdishes are made in a second hydrophilic material (26, 57), solely the first hydrophilic material being able to fix the chemical or biological reagent.

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5. Device according to any of claims 1 to 4, in which the hydrophilic material(s) contain hydrophilic groups chosen from among the epoxy groups, -OH, -SH, -NH-, $-NH_2$ and -COOH.

6. Device according to any of claims 1 to 4, in which the hydrophobic material contains hydrophobic groups chosen from among the hydrocarbon- and fluorocarbon-containing groups.

7. Device according to claims 4 and 5, in which the first hydrophilic material contains hydrophilic groups different to those of the second hydrophilic material.

8. Device according to any of claims 1 to 7, in which the carrier comprises an active substrate with an integrated electronic system having electronic functions.

9. Device according to any of claims 1 to 8, in which the biological reagent is an oligonucleotide.

10. Method for producing a device for chemical or biological analysis according to claim 3, comprising the following steps:

a) hollowing out microdishes on the surface of the carrier,

b) defining the areas of the carrier surface which are to contain a hydrophobic material, and

c) forming a hydrophilic material on the areas of the carrier surface and microdishes not containing any hydrophobic material.

11. Method for producing a device for chemical or biological analysis according to claim 3, comprising the following steps:

a) hollowing out microdishes on the carrier surface, and

b) forming a hydrophilic material on the areas of the carrier surface which are to contain a hydrophilic material.

12. Method for producing a device for chemical or biological analysis according to claim 4, which comprises the following steps:

a) hollowing out microdishes on the surface of the carrier,

b) defining the areas of the carrier surface which are to contain a hydrophobic material,

c) defining, on the carrier surface not containing any hydrophobic material and on the surface of the microdishes, first areas corresponding to the sites of the first hydrophilic material and second areas corresponding to the sites of the second hydrophilic material, and

d) forming the first hydrophilic material on the first areas and the second hydrophilic material on the second areas.

13. Method according to any of claims 10 to 12 comprising an additional step to form a hydrophobic material on the areas of the carrier surface which are to contain a hydrophobic material.

14. Method according to any of claims 10 to 13, in which the microdishes are formed by etching.

15. Method according to any of claims 10 to 13, in which the carrier comprises a surface layer in a polymer or a mineral oxide deposited on an active substrate having an electronic function, and the microdishes are made by etching in the polymer or oxide layer.

16. Method according to claim 13, in which the carrier being in silicon or in glass, the hydrophobic material is formed by reaction of the glass or silicon, previously subjected to oxidation, with a hydrophobic silanisation agent.

17. Method according to claim 16, in which the hydrophobic silanisation agent is a silane having the formula:

$$\left.\begin{matrix}R^1\\R^2\\R^3\end{matrix}\right> Si-R^4$$

in which R^1, R^2 and R^3, which may be identical or different, are chosen from among the C_1 to C_3 alcoxy groups and the halogen atoms, and R^4 is a hydrocarbon- or fluorocarbon-containing group, either linear or branched.

18. Method according to any of claims 10 to 13, in which the carrier being in silicon or glass, the hydrophilic material is formed by reaction of the glass or silicon, previously subjected to oxidation, with a hydrophilic silanisation agent.

19. Method according to claim 18, in which the hydrophilic silanisation agent is a silane having the formula:

$$\left.\begin{matrix}R^1\\R^2\\R^3\end{matrix}\right\rangle Si-R^5$$

in which R^1, R^2 and R^3 which may be identical or different, are chosen from among the C_1 to C_3 alcoxy groups and the halogen atoms, and R^5 is a hydrocarbon-containing group, linear or branched, comprising at least one hydrophilic group chosen from among the epoxy groups, -OH, -SH, $-NH_2$ and -COOH.

20. Method according to claim 13, in which the hydrophobic material is formed by reaction of a metallic layer in gold, silver, copper or one of their alloys, deposited on the areas of the carrier surface which are to be formed of hydrophobic material, by reaction of this layer with a thiol or a disulfide containing a hydrophobic hydrocarbon- or fluorocarbon-containing group.

21. Method according to any of claims 10 to 13, in which the hydrophilic material is formed by reaction of a metallic layer in gold, silver, copper or one of their alloys, deposited on the areas of the carrier which are to be formed of the hydrophilic material, by reaction of this layer with a thiol or a disulfide comprising at least one hydrophilic group chosen from among the epoxy groups, -OH, -SH, -NH, $-NH_2$ and -COOH.